EXAMPLES OF UNDULATING CONDUITS

Figure 2.

$r_i = r_c - r_h$

$r_o = r_c + r_h$

Conduit with Helical Undulation
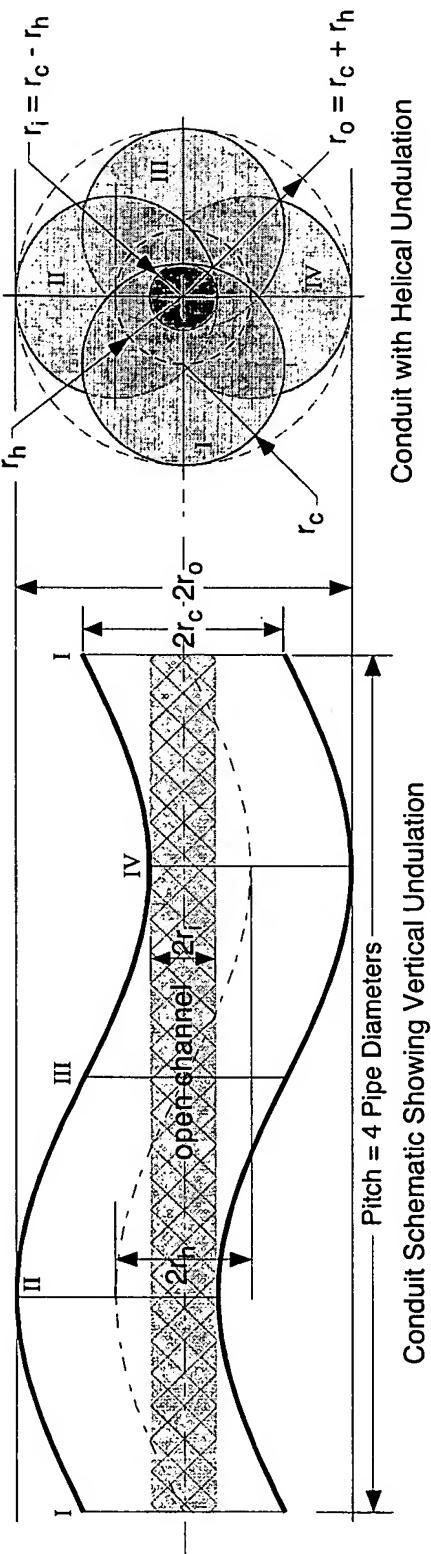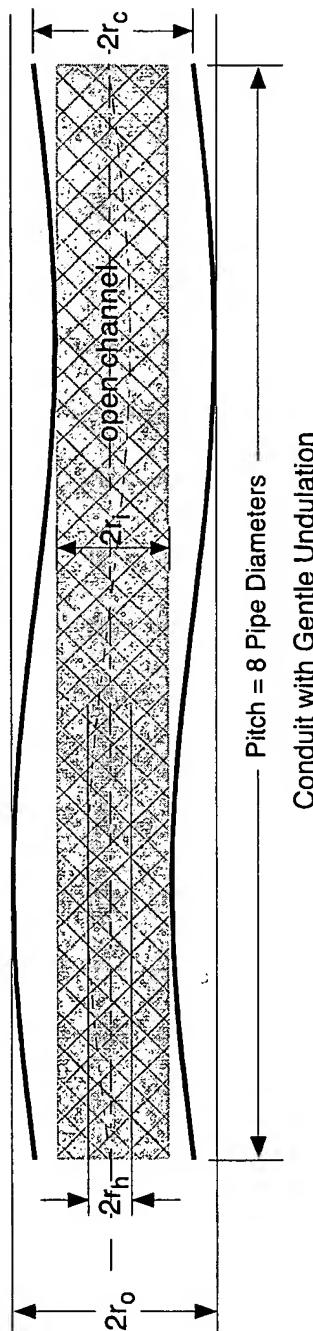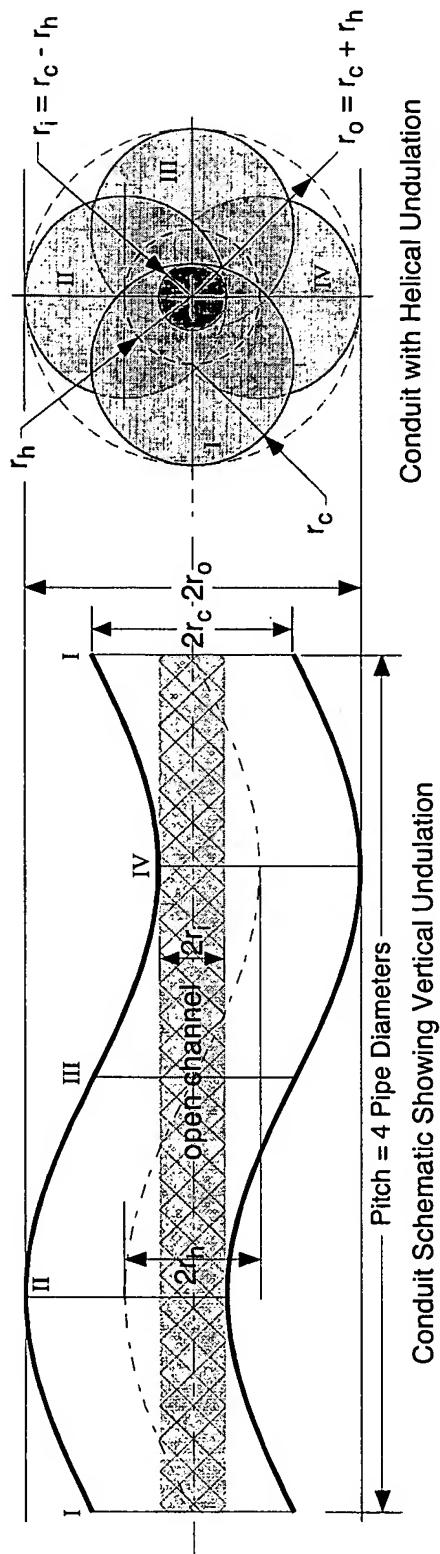
r_c = radius of conduit
r_h = radius of helical path of conduit centerline
$r_o = r_c + r_h$ = outer radius of conduit helix
$r_i = r_c - r_h$ = radius of open interior channel ($r_c \geq r_h$)
 $= r_h - r_c$ = inner radius of conduit helix ($r_c < r_h$)

Figure 1.

Pitch = 4 Pipe Diameters

Conduit Schematic Showing Vertical Undulation

Figure 3.

Pitch = 8 Pipe Diameters

Conduit with Gentle Undulation

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Title: Hydrodynamic Static Mixing Apparatus and
Method for Use Thereof in Transporting, ...
*****

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Fig. 4a

Fig. 4b
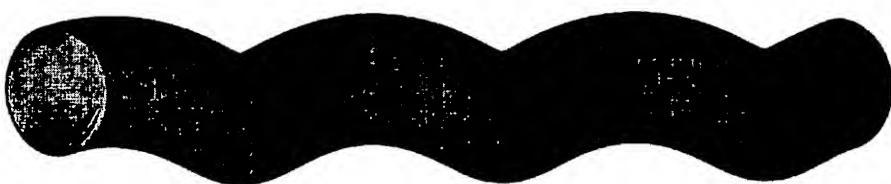
Fig. 4c

Figure 4. End and Oblique Views of a Short Section of Helical Undulating Conduit Having a Circular Cross-Section and Open Center Channel

Fig. 5a

Fig. 5b

Fig. 5c

Fig. 5d

r_c
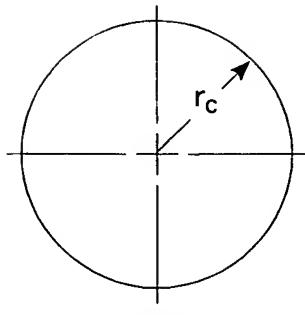
Circle
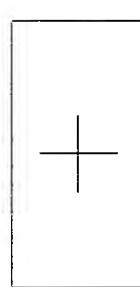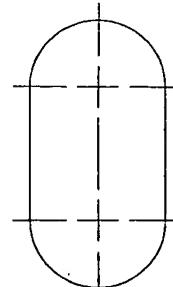
Polygon
(4 sides)

Composite
(round-end
polygon)
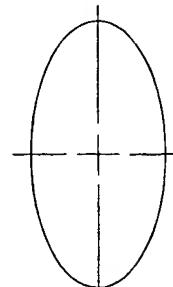
Ellipse

Figure 5. Some Cross-Sectional Shapes for Undulating Conduits

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Fig. 6b
Magnified end view of spiral conduit showing open center channel

Conduit
Transition Connectors
Not Shown

Fig. 6c
Trimetric View of Undulating Conduit 'Flow Revitalizer' Insert Between Round Pipe Sections

Reversed Twist

Fig. 6a
Side View of Spiral-Twisted Undulating Conduit with Oval Cross-Section

Figure 6.   Examples of Spiral-Twisted Undulating Conduit

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Figure 7
Use Of Undulating Conduit Hydrodynamic Mixers In A Bitumen Extraction Circuit

Legend

1. Oil Sand
2. Oversize
3. Sized Tar Sand
4. Recycled Middlings + Chemicals
5. Raw Slurry (short retention time)
6. Screen Spray (recycled liquid)
7. Coarse Reject
8. Conditioned Slurry
9. Sand Settler Middlings Recycle
10. Oil Enriched Middlings
11. Froth Separator Middlings Recycle
12. Froth Separator Tailings
13. Primary Froth
14. Secondary Oil Recovery Froth
15. Secondary Oil Recovery Tailings
16. Sand Separator Tailings
17. Conditioning Control
    (water, additives, etc.)